TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2079 Ashwin

Exam.	Back		
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

Subject: - Database Management System *(CT 652)*

- Candidates are required to give their answers in their own words as far as practicable.
- *Attempt <u>All</u> questions.*
- *The figures in the margin indicate <u>Full Marks</u>.*
- *Assume suitable data if necessary.*

1. What do you mean by Schema and Instances? Briefly explain the different level of data abstraction. [2+3]

2. Draw an ER diagram for the mini-case "Procurement department of an Organization (ABC) keeps track of all the items such as Furniture and equipment in the offices. There are several buildings of the ABC and each one is given a different name to identify it. Each item is assigned a unique ID when it is purchased. This ID is used to keep track of the item, which is assigned to a room within a building. Each room within a building is assigned to a department". Document all assumptions that you make about the mapping constraints. [8]

3. Consider the following relational database model:

Hotel (Hotel_No, Name, Address)
Room (Room_No, Hotel_No, Type, Price)
Booking (Hotel_No, Guest_No, Date_From,, Date_To, Room_No)
Guest (Guest_No, Name, Address)

Write SQL statement for the following:

a) List all the guests who have booked rooms at the Everest Hotel.
b) Create a view to expose only the Hotel_No, Guest_No, Room_No. and price of the room of all booked rooms.
c) Find total cost of all the deluxe room of Everest Hotel after offering 5% discount.
d) Identify the Hotel name which has the highest total guests. [4×2]

4. For the relational database model given in the Question No. 3. Write relational algebraic expression for the following:

a) List the name Hotels in Kathmandu.
b) List the Name of Hotels and their all available types of room with price.
c) List all the guest name who have booked deluxe room of Everest Hotel.
d) List total number of rooms booked (type wise) of the Everest Hotel. [4×2]

5. Suppose that we decompose the schema R = (A, B, C) into R1 = (A, B), R2 = (A, C). Show that this decomposition is a lossless join decomposition and not dependency preserving if the F = {A->B, B->C} [2+2]

6. Briefly explain 1NF, 2NF, 3NF and BCNF with suitable illustrations. [2+2+2+2]

7. Explain the process how query is evaluated in RDBMS system. How are equivalence rules for relation algebra helpful for query optimization? Explain with example. [4+4]

8. What do you mean by ordered index and hash index? Explain limitation of static hashing. How extendable hashing overcome such limitation? [3+2+2]

9. What are possible transaction states? Briefly explain any two dead lock handling mechanism with suitable examples. [3+5]

10. Write the different types of failures that may occur in DBMS. Differentiate between shadow paging and log-based recovery. [4+4]

11. Write short notes on: [2×4]

TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2079 Jestha

Exam.	Back		
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

Subject: - Database Management System *(CT 652)*

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt All questions.*
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1. Define database language. Compare the DBMS with file processing system. [2+3]

2. Explain the distinctions among the terms primary key, candidate key and super key with suitable example.
   Consider an ONLINE AUCTION database system in which members participate in the sale of items. The data requirements for this system are summarized as follows: The online site has members, each of whom is identified by a unique member number and is described by an e-mail address, name, password, home address and phone number. A member may be a buyer and seller. A buyer has a shipping address recorded in the database. A seller has a bank account number and routing number recorded in the database. Items are placed by a seller for sale and are identified by a unique item number assigned by the system. Items are also described by an item title, a description, starting bid price, bidding increment, the start date of the auction and the end date of the auction. Items are also categorized based on a fixed classification hierarchy. Buyers make bids for items they are interested in. Bid price and time of bid is recorded. The bidder at the end of the auction with the highest bid price is declared the winner and a transaction between buyer and seller may then proceed. The buyer and seller may record feedback regarding their completed transactions. Feedback contains a rating of the other party participating in the transaction (1-10) and a comment. Design an Entity-Relationship diagram for the ONLINE AUCTION database. [3+8]

3. a) Consider the relational database as follows: [4×2]

   Worker (worker_id, first_name, last_name, salary, joining_date, department)
   Bonus (worker_id, bonus_amount, bonus_date)
   Title (worker_id, worker_title, affected_from)

   (i) Write an expression in SQL to fetch unique values of department from worker table.
   (ii) Write an expression in SQL to print details of Workers with DEPARTMENT name as "Admin".
   (iii) Write an expression in SQL to print details of Workers who are also Managers.
   (iv) Write an expression in SQL to show the second highest salary from a table.

   b) Consider the following relational model. [3×2]

   passenger (pid, pname, pgender, pcity)
   agency (aid, aname, acity)
   flight (fid, fdate, time, src, dest)
   booking (pid, aid, fid, fdate)

   (i) Write an expression in relational algebra get the details about all flights from Kathmandu to Biratnagar.
   (ii) Write an expression in relational algebra to find only the flight numbers for passenger with pid is 123 for flights to Kathmandu before 06/11/2020.
   (iii) Write skeleton table in QBE to find the details of all male passengers who are associated with Jet agency.

4. a) What are the various problems without normalization? Explain. [3]

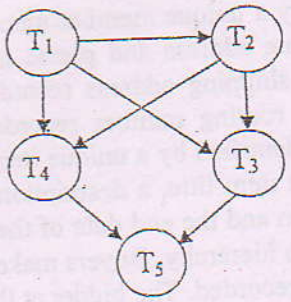
   b) Define partial and transitive dependency with example. Given a relation R(A, B, C, D) and Functional Dependency set FD = {AB → CD, B → C}, determine whether the given R is in 2NF? If not convert it into 2 NF. [2+5]

5. What are functions of the parser and optimizer in query processing? Compare nested loop join and block nested loop join with reference to its algorithm and cost analysis. [2+6]

6. Distinguish between primary and secondary index? Perform the insertion operation in B+ tree for the following sequence:- 1, 3, 5, 7, 9, 2, 4, 6, 8, 10 [2+6]

7. a) Define transaction and transaction processing system. What are the situations that occur if the proper isolation is not maintain in transaction? Explain with example. [2+2]

   b) Since every conflict-serializable schedule is view serializable, why do we emphasize conflict serializability rather than view serializability? Consider the precedence graph given below. Is the corresponding schedule conflict serializable? Explain your answer. [3+4]



8. Explain the need of recovery techniques. Compare the shadow-paging recovery scheme with the log-based recovery schemes in terms of ease of implementation and overhead cost. [3+4]

9. Write short notes on: [2×3]

   a) Transparency of distributed DBMS
   b) Spatial database

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TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2078 Chaitra

Exam.	Regular		
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

Subject: - Database Management System *(CT 652)*

- Candidates are required to give their answers in their own words as far as practicable.
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2. Define the terms Data Abstraction and Data Independence. Why they are important in DBMS? [2+3]

3. An University Registar's Office maintains data about the following entities: [8]

   i) Courses, including number, title, credits, syllabus and prerequisites;
   ii) Course Offerings, including course number, year, semester, section number, instructors, timings, and classroom;
   iii) Students, including student id, name and program;
   iv) Instructors, including identification number, name department and title.

Further, the enrolment of students in course and grade awarded to students in each course they are enrolled for must be appropriately modelled. Construct an E-R diagram for the Registrar's office. Document all assumptions that you make about the mapping constraints.

4. Consider the following relational database model: [2×4]

Passenger (pid, pname, pgender, pbirthplace)

Agency (aid, aname, acity)

Flight (fid, fdate, time, source, destination)

Booking (pid, aid, fid, bookdate, amount)

Write SQL statement for the following:

a) Find all the passenger details who are travelling from "Kathmandu" to "Pokhara".
b) Update the booking amount with 10% discount if the flight destination is same as the passenger's birth city.
c) Create a View named "EsewaReport" in which calculate the total amount of booking made in the current date through the agency having name "Esewa".
d) List Flight wise total number of bookings for current date.

5. For the relational database model given in the Question No. 3. Write relational algebraic expression for the following: [2×4]

a) Find the details of all flights to "Kathmandu".
b) Find name of all passengers who have booked at least one flight.
c) List the name of all agencies who have made highest booking till date.
d) Find all the passenger who have booked from agency "Esewa".

5. Suppose that we decompose the schema R = (A,B,C,D,E) into (A,B,C) and (C,D,E). Is it lossless decomposition? Does it preserve dependencies? Consider the following set F of functional dependencies hold A→BC; CD→E; B→D; E→A [2+

6. What is Normalization? Why is it important? Differentiate between 3NF and BCNF with suitable examples. [1+1+

7. Define query processing and briefly explain its steps. How is pipeline approach different from the materialization approach? [4+

8. Why does RAID Level 6 give better data protection then RAID 5? Briefly explain Fixed Length Record and Variable Length record along with suitable examples. [3+

9. Briefly explain ACID properties of a transaction. How two-phase locking protocol does ensures conflict-serializable schedule? [4+

10. How does the check point recovery take place in case of transaction failure? Briefly discuss on the shadow paging technique for recovery. [4+

11. Write short notes on [4+

    a) Important of Data Warehouses
    b) Spatial database.

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TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
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2078 Poush

Exam.	Back		
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Programme	BCT	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

Subject: - Database Management System *(CT 652)*

- Candidates are required to give their answers in their own words as far as practicable.
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1. Describe the different levels of abstraction in database. Discuss the significance of this abstraction. [3+1]

2. Draw an ER-diagram for the following mini-case

Each employee in an engineering company has at most one recognized skill, but a given skill may be possessed by several employees. An employee is able to operate a given machine-type (e.g., lathe, grinder) if he has one of several skills, but each skill is associated with the operation of only one machine type. Possession of a given skill (e.g., mechanic, electrician) allows an employee to maintain several machine-types, although maintenance of any given machine-type requires a specific skill (e.g., a lathe must be maintained by a mechanic).

What is a weak entity set and identifying relationship? Explain with example. [8+4]

3. Consider the following relational database model

account (account-number, branch-name, balance)
loan (loan-number, branch-name, amount)
customer (customer-name, customer-street, customer-city)
depositor (customer_name, account_number)
borrower (customer_name, loan_number)
branch (branch-name, branch-city, assets)

Write relational algebra expressions for the following: [2×4]

a) Find the names and street address of all customers who have an account at the "Thapathali" branch.
b) Find the names of all customers who have an account with balance more than 10,00,000.
c) Delete all loan records with amount in the range of 0 to 500.
d) Show the number of accounts in each branch along with the branch-name.

4. Consider the relational schema given below. [2×4]

Product (pid, name, price, category, maker-cid)
Purchase (buyer-ssn, seller-ssn, quantity, pid)
Company (cid, name, stock price, country)
Person (ssn, name, phone number, city)

a) Write an SQL query to find the name all products made in "China" with price less than 10,000.
b) Write an SQL query to create a view to expose product name and total quantity sold from all transactions.
c) Write a query in SQL to increase the price of all products of "Laptop" category by 5%.
d) Write an SQL query to create the table Product assuming appropriate data types and

5. a) Explain what are super key, candidate key and primary key in tables with proper examples. Explain what is foreign key constraint along with an example.

   b) Describe what is 2NF and 3NF. Formally define BCNF.

6. Explain the process of query optimization. What is heuristic optimization?

7. a) What is the difference between primary index and secondary index? Briefly explain what is a hash index.

   b) What is RAID and what are its advantages? Explain what block level striping is.

8. Explain the ACID properties of transactions. Explain the states of a transaction along with a state-transition diagram.

9. What is a stable storage? Briefly explain how log-based recovery woks.

10. Write short notes on the following:

    a) Distributed databases
    b) Data warehouse

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TRIBHUVAN UNIVERSITY
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2078 Baishakh

Exam.	Back		
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

Subject: - Database Management System *(CT 652)*

Candidates are required to give their answers in their own words as far as practicable.
Attempt All questions.
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a) Why is database system more preferred over file system? Explain briefly. [4]

b) Define total participation with an example. Explain weak entity set with an example. [2+2]

c) A publishing company produces books on various subject. The books are written by authors who specializes in one particular subject. The company employs editors who, not necessarily being specialists in a particular area, each take sole responsibility for editing one or more book publications. Every book requires some items for publication. These items supplied by suppliers. One supplier can supply many items. Shop owner buys books from the publisher. Shop owner can buy many books but one book can be bought by one shop owner only. Books are uniquely identified by Bookid. Draw ER-diagram for above scenario. Use necessary attributes for each entity. [8]

d) Consider the following relational data model.
Salesman(salesman_id, name, commission, city)
Customer(customer_id, cust_name, city, grade, salesman_id)
Order(order_id, Purchase_amt, order_date, customer_id, salesman_id)
Write down the SQL query for the following:
(i) Find the customer names and the salesman names and city who lives in the same city.
(ii) Find the names of all customers along with the salesman who works for them.
(iii) Find all the orders by the customers not located in the same cities where their salesman lives.
(iv) Find the total number of orders handled by each salesman along with his/her name. [4×2]

e) Consider the following relational database. [2×4]
Flights (flight_no, from, to, distance, depart_time, range)
Aircraft(aircraft_id, aircraft_name, range)
Certified(emp_id, aircraft_d)
Employees(emp_id, ename, salary)
Write the relational algebra expressions for the following:
(i) Find the empids and names of pilots certified for Boeing aircraft.
(ii) Find the names of aircraft such that all pilots certified to operate them earn more than 80,000.
(iii) Increase the salary of all employees by 5% who earn less than 100,000.
(iv) Find the names of pilots who can operate planes with a range greater than 3,000 miles but are not certified on any Boeing aircraft.

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4. a) Explain why normalization is necessary? Explain 1NF, 2NF, and 3NF with example. [3+5]
   b) What is the role of functional dependencies in normalization? Explain lossy and lossless decomposition. [2+4]
5. Explain with diagram about steps involved in query processing. Briefly explain about the approaches used for query optimization. [5+3]
6. a) What is record organization? Explain primary and secondary indexing with example. [1+5]
   b) Explain the distinction between static and dynamic hashing with approximate example. [4]
7. Define transaction and explain various states of a transaction. What do you mean by concurrent execution and describe about two phase locking protocol along with its limitations? [4+4]
8. Explain the deferred database modification of log based recovery scheme. Explain the steps along with an example. [6]
9. Write short notes on: [2×3]
   a) Data Warehouse
   b) Remote Backup System

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TRIBHUVAN UNIVERSITY
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Examination Control Division
2076 Baisakh

Exam.	Back		
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

Subject: - Database Management System *(CT 652)*

Candidates are required to give their answers in their own words as far as practicable.
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Differentiate between schema and instances. What are the disadvantages of conventional file system? [4]

Define data independence and explain its significance. What is importance of aggregation in ER design? Discuss with an example. [2+2]

Draw an E-R diagram for the given case. [8]

A company having a chain of pharmacies wishes you to design a database for the company. Patients are identified by an SSN, and their names, addresses, and ages must be recorded. Doctors are identified by an SSN. For each doctor, the name, specialty, and years of experience must be recorded. Each pharmaceutical company is identified by name and has a phone number. For each drug, the trade name and formula must be recorded. Each drug is sold by a given pharmaceutical company, and the trade name identifies a drug uniquely from among the products of that company. If a pharmaceutical company is deleted, you need not keep track of its products any longer. Each pharmacy has a name, address, and phone number. Every patient has a primary physician. Every doctor has at least one patient. Each pharmacy sells several drugs and has a price for each. A drug could be sold at several pharmacies, and the price could vary from one pharmacy to another. Doctors prescribe drugs for patients. A doctor could prescribe one or more drugs for several patients, and a patient could obtain prescriptions from several doctors. Each prescription has a date and a quantity associated with it. You can assume that if a doctor prescribes the same drug for the same patient more than once, only the last such Prescription needs to be stored. Pharmaceutical companies have long-term contracts with pharmacies. A pharmaceutical company can contract with several pharmacies, and a pharmacy can contract with several pharmaceutical companies. For each contract, you have to store a start date, an end date, and the text of the contract. Pharmacies appoint a supervisor for each contract. There must always be a supervisor for each contract, but the contract supervisor can change over the lifetime of the contract.

Write SQL query. [Consider following relations] [8]
Product(Pid, Pname, Price, description)
Customer(Cid, Cname, Address)
Sell(Pid, Cid, quantity)
a. Retrieve the record of product who were sold to customer id 12.
b. Create above table product as indicated.
c. Find the product whose sells quantity is maximum.
d. Find the total number of customer whose name start with S.

4. Write relational algebra. [Consider following relations.] [8]
   Emp (Eid, Ename, Address, Salary, Dptid)
   Depart(Dptid, Dname)
   a) Insert a single record in Emp table.(100,'Ram','Balaju',10000,5)
   b) Retrieve the record of employee who earns more than 10000 in computer department.
   c) Increase the salary of all employee by 10 percent.
   d) Delete all the record of employee who are from ELX department. (Dptid='ELX')

5. a) What do you mean by closure of functional dependency? What is a trigger in DBMS? Is it safe or risky to use triggers? Explain. [3+3]
   b) Define normalization and levels of normalization 1NF, 2NF and 3NF. Compare the advantage of BCNF over 3NF. [4+2]

6. Explain the basic steps in query processing with diagram? What is pipelining in query evaluation. Explain with an example. [5+3]

7. a) What do you mean by hashing and indexing? Differentiate between dense index and sparse index? [2+2]
   b) Write about fixed length record and variable length record organization in DBMS? [4]

8. a) What is transaction? What are the ideal properties of a transaction? [1+4]
   b) Describe strict two-phase locking protocol (2PL). [3]

9. Define term Recovery and Atomicity in database. Consider the following log contents when a crash occurs. Explain how recovery would be done for each state. [2+4]

(a)	(b)	(c)
$<T_o$ start>	$<T_o$ start>	$<T_o$ start>
$<T_o$, A, 1000, 950>	$<T_o$, A, 1000, 950>	$<T_o$, A, 1000, 950>
$<T_o$, B, 2000, 2050>	$<T_o$, B, 2000, 2050>	$<T_o$, B, 2000, 2050>
	$<T_o$ commit>	$<T_o$ commit>
	$<T_1$ start>	$<T_1$ start>
	$<T_1$, C, 700, 600>	$<T_1$, C, 700, 600>
		$<T_1$ commit>

10. Write short notes on: [3+3]
    a) Distributed database
    b) Remote Backup System

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33 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2075 Bhadra

Exam.	Regular		
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

Subject: - Database Management System *(CT652)*

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt **All** questions.*
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1. What do you mean by scheme and instances? Mention the different levels of data abstraction and explain. [2+2]

2. a) Identify relevant attributes and construct an ER diagram with proper mapping constraints for a university which has many departments and each department has multiple instructors; one among them is the head of the department. An instructor belongs to only one department, each department offers multiple courses, each of which is taught by a single instructor. A student may enroll for many courses offered by different departments. [6]

   b) Define unary relationship along with example. How you convert an ER relationship into relation schema? Explain with examples of different cardinalities. [2+4]

3. a) Consider the following relational data model. [2×4]

   Student (crn, name, address, phone, dob)

   Course (courseid, crn, duration, fee)

   Enroll (enrolled, cname, courseid, enrolldata, completedata)

   i) Write the SQL statements required to create the above relations, including appropriate versions of all primary and foreign key integrity constraints,
   ii) Write an expression in SQL to find crn, names and enroll data of all students who have taken the course 'java' (cname)
   iii) Write SQL to find the names and address of all the students who have taken both course java and linux.
   iv) Write an expression in SQL to Create a view 'student_course' having the attributes crn, name, phone, coursename, enrolldata

   b) Consider the following relational database [2×4]

   sailor (sailorid, sname, rating, age)

   boat (boatid, boatname, color)

   reserves (sailorid, boatid, date)

   Write relational algebra expressions for the following:

   i) Find the names of sailor who has reserved boat number 105.
   ii) Find the names of sailors who have reserved a red boat.
   iii) Find the names of all sailor who have reserved either a red boat or a green boat.
   iv) Give an expression in QBE to find the sailors name and age who have reserved a red boat.

4. a) Why do we need normalization? Differentiate primary key and foreign key. Differentiate between 3NF and BCNF. [2+2+3]

   b) Consider the relation Treatment with the schema: Treatment (doctorID, doctorName, PatientID, diagnosis) and functional dependencies; [5]

   doctorID→doctorName and (doctorID, patientID)→diagnosis.

   Describe different types of problem that can arise for this relation with records

5. Explain with diagram about process of query processing in RDBMS. How are equivalence rules for relational algebra helpful for query optimization? Explain with example. [5+3]

6. a) Describe about fixed-length record and variable length record along with examples. [4]

   b) Describe B+ tree structure used for indexing. [4]

7. Define transaction and explain various states of a transaction with a transition diagram. Describe about two phase locking protocol for concurrent transaction along with its limitations. [4+4]

8. Write the different types of failures that may occur in system. Differentiate between shadow paging and log-based recovery. [3+3]

9. a) Write about data warehouse with its components. [4]

   b) Write about spatial database. [2]

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45 TRIBHUVAN UNIVERSITY
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2075 Baisakh

Exam.	Back		
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Programme	BCT	Pass Marks	32
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Subject: - Database Management System *(CT652)*

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1. Define Data Abstraction. Explain its different levels with suitable example. [1+3]
2. Construct an ER-Diagram for the following NFL database.

   You are given the requirement for a simple database for the National Football League (NFL). The NFL has many teams, and each team has a name, a city, a coach, a captain and a set of players. Each player belongs to only one team and each player has a name, a position (such as left wing, mid fielder or a goalkeeper) a skill level, and a set of injury records. A team captain is also a player and a game is played between two teams (referred as host team and guest team) and has a match date (such as June 11, 2018) and score (such as 2 to 5).

   Explain strong and weak entity sets along with example. [8+4]
3. Consider the following relational schema:

   tblsalesman(s_id, name, city, commission)
   tblOrders(ord_no, prch_amt, ord_date, c_id, s_id)
   tblCustomer(c_id, name, city, grade, s_id)

   Write SQL query expression to [2×4]

   a) find those salesmen with all information whose name containing the 1st character is 'N' and the 4th character is 'R' and rests may be any character.
   b) Find the highest purchase amount on a date '2017-07-17' for each salesman with their ID.
   c) count the customers with grades above Kathmandu's average.
   d) Increase commission of salesmen by 2% if they are from humla.
4. Consider the following relational database model

   Author(a_name, citizenship, birthYear)
   Topic(isbn, subject)
   Instock(isbn, libname, quantity)
   Book(isbn, title, a_name)
   Branch(libname, city)

   Write relational algebra expressions for the following: [2×4]

   a) Give the cities where each book is held.
   b) Give the title and author of each book of whichat least two copies are held in a branch located in Kathmandu.
   c) Delete those books that are from author 'xyz'
   d) List total no. of available books of each subject.

5. a) What is a functional dependency? List the various integrity constraints and explain about the referential integrity along with an example. [3+3]

   b) Define 1NF, 2NF and 3NF. Illustrate your answer with suitable example. [6]

6. What is the task of evaluation engine in query processing? Explain cost based query optimization and Heuristic optimization. [4+4]

7. a) What is the difference between ordered indices and hash indices in a database? What is the advantage of using sparse index? [2+2]

   b) Write about fixed length record and variable length record organization in DBMS? [4]

8. Explain the possible transaction states in DBMS. Explain the concept of conflict searilizability with an example. [4+4]

9. Explain the idea of log-based recovery. [6]

10. a) Explain homogenous and heterogeneous distributed database. [4]

    b) What is Spatial Database System? [2]

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45 TRIBHUVAN UNIVERSITY
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2074 Bhadra

Exam.	Regular		
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Subject: - Database Management System *(CT652)*

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1. Mention the advantages of the DBMS over the file processing system and explain briefly. [4]
2. a) Define discriminator in ER diagram. Explain different keys used in database design. [4]

   b) Draw the Entity-Relationship Diagram (ERD) with appropriate mapping cardinalities for the following scenario.

   A Production company consists of a machining, fabrication and assembly department. Employees are assigned to different departments. Each department is managed by a manager. Each employee has at most one recognized skill, but a given skill may be possessed by several employees. An employee is able to operate a given machine-type (e.g. lathe, grinder, welding) of each department. Some of the employees are paid overtime and some of them are paid with daily basis. According to their designation (eg. mechanic, welder) are supposed to maintain at least one machine-type of their department. Raw materials are bought from different vendors and fetched to the machining department. Parts from machining department are fetched to fabrication department and so on. Many parts are assembled together to form a product. The final products from assembly department are stored in the ware house. Products are labeled with different specifications (eg, Product_Id, Product_type, MRP, etc). [8]
3. Consider the following relational data model [2×4]

   Employee (empid, ename, age, salary)
   Department (deptid, dname, budget, managerid)
   Works (empid, deptid, hours)

   (i) Write the SQL statements required to create the above relations, including appropriate versions of all primary and foreign key integrity constraints.
   (ii) Write an expression in SQL to find the name of department whose employee earns the maximum salary.
   (iii) Write SQL to find the name of the employee, department name and the number of hours they work
   (iv) Write an expression in SQL to give every employee a 20% raise in salary whose age is in between 45 to 50 years.
4. Consider the following relational database [2×4]

   Account (account-number, branch-name, balance)
   Branch (branch-name, branch-city, assets)
   Customer (cust-name, cust-street, cust-city)
   Loan (loan-number, branch-name, amount)
   Depositor (cust-name, account-number)
   Borrower (cust-name, loan-number)

   Write the relational algebra expressions for the following:

(i) Find the names of customers who has loan at "Koteshwor" branch.
(ii) Find the largest account balance.
(iii) Find the names of all depositors along with their account number, street and city address.
(iv) Give an expression in QBE to find the customer name, loan number and amount for all customers who have a loan from the "Koteshwor" branch.

5. a) What are Triggers? Define Domain constraint and Referential Integrity constraint with an example. [1+4]

   b) What is the role Functional dependencies in Normalization? Explain trivial and non-trivial dependencies. Explain BCNF. [2+2+3]

6. Explain about the steps involved in query optimization. How is pipelining approach different from the materialization approach? [3+5]

7. Discuss about sequential file organization and multi-table clustering file organization. Explain dense index file and sparse index file. [4+4]

8. Explain ACID properties of a database transaction. Describe how conflict serializability differs from the view serializability for concurrent execution of transactions. [4+4]

9. What is the purpose of implementing check points in data recovery mechanism? What are the recovery actions performed if failure arises at the end of the given transaction states? [2+4]

<T_0 start>
<T_0, A, 1000, 950>
<T_0, B, 2000, 2050>

(a)

<T_0 start>
<T_0, A, 1000, 950>
<T_0, B, 2000, 2050>
<T_0 commit>
<T_1 start>
<T_1, C, 700, 600>

(b)

10. Write short notes on: [3+3]

    a) Spatial database b) Remote Backup System

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45 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2073 Magh

Exam.	New Back (2066 & Later Batch)		
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

Subject: - Database Management System *(CT652)*

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt **All** questions.*
- ✓ *The figures in the margin indicate **Full Marks**.*
- ✓ *Assume suitable data if necessary.*

1. What do you mean by data abstraction? List the various level of data abstraction and briefly explain. [1+3]

2. a) What are data models? Explain various types of data models. [1+3]

   b) Design an E-R diagram for a database for an airlines system. The database must keep track of customers and their reservations, flights and their status, seat assignments on individual flights and the schedule and routing of future flights. Apply all the database design constraints as much as possible. [8]

3. a) Consider the following relational data model. [2×3]

   Employee(empid, name, address, manager_id)

   Department(deptid, dname)

   Project(pid, title, budget, deptid)

   Works_on(empid, pid, hours)

   Write down the relational algebraic expression for the following:

   i. Find the names of all employee from computer department along with their manager name.

   ii. Find the names of all the employees who works on project with budget more than 50000.

   ii. Find the total number of projects from each department along with the department name.

   b) Write down the SQL queries for following: [2×3]

   i) Find the name of employees who works on project with the highest budget.

   ii) Create a view with empid, name, project title and budget.

   iii) Update the budget of all project by 20% where any employee works for more than 12 hours.

4. a) Define functional dependency. Explain partial and transitive functional dependency with example. [1+4]

   b) Define decomposition and its desirable properties. Explain 3NF and BCNF. [3+4]

5. Define query processing. Explain the various approaches used to evaluate any expression with suitable example. [2+6]

6. a) What is RAID? Which RAID level would you prefer the best for safety of application and why? [1+3]

   b) What is indexing? Why dynamic hashing is advantageous over static hashing? [1+3]

7. a) Define ACID properties of a transaction. Describe the concept of conflict serializability for concurrent execution of transactions. [4+4]

   b) How two phase looking protocol helps in concurrency control? Explain. [4]

8. What is stable storage? Explain the log based recovery mechanism. [2+4]

9. a) Describe briefly about object oriented database. [3]

   b) Explain the differences between homogenous and heterogeneous distributed database. [3]

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45 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2073 Bhadra

Exam.	Regular		
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

Subject: - Database Management System *(CT652)*

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt **All** questions.*
- ✓ *The figures in the margin indicate **Full Marks**.*
- ✓ *Assume suitable data if necessary.*

1. Why is data independence important in data modeling? Differentiate between schema and instances. [4]
2. Differentiate total and partial participation with suitable example and draw an ER diagram for the airport database. Be sure to indicate the various attributes of each entity. Every airplane has a registration number and each airplane is of a specific model. The airport accommodates a number of airplane models and each model is identified by a model number (eg DC-10) and has a capacity and a weight. A number of technician works at the airport. You need to store the name, SSN, address, phone number and salary of each technician. Each technician is an expert on one or more plane model(s) and his or her expertise may overlap with that of other technicians. This information about technicians must also be recorded. Traffic controllers must have an annual medical examination. For each traffic controller you must store the data of the most recent exam. [4+8]
3. Consider the following relational schema

   Employee (Ename, street, city)

   Works (Ename, company_name, salary)

   Company (company_name, city)

   Manages (Ename, manager_name)

   a) Write the queries in Relational Algebra. [2×3]

      i. Find all the employees name who work in 'NMB bank'.

      ii. Find all the employee names who live in the same city as their company is located.

      iii. Find the name and city of those employees whose salary is greater than 30000 and lives in 'ktm' city.

   b) Write SQL queries for the following. [2×3]

      i. Create Employee and Works relation with primary key and foreign key constraints.

      ii. Find the employee name their company name and city name which ends with 'pur' as substring.

      iii. Increase the salary of each employees by 25% whose salary is less than 30000.

4. a) What do you mean by functional dependencies? Define formally. What is BCNF? [3+3]
   b) What is normalization? Explain INF, 2NF, 3NF and 4NF. [2+4]

45 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2073 Bhadra

Exam.	Regular		
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

Subject: - Database Management System *(CT652)*

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt **All** questions.*
- ✓ *The figures in the margin indicate **Full Marks**.*
- ✓ *Assume suitable data if necessary.*

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   Works (Ename, company_name, salary)

   Company (company_name, city)

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      i. Create Employee and Works relation with primary key and foreign key constraints.

      ii. Find the employee name their company name and city name which ends with 'pur' as substring.

      iii. Increase the salary of each employees by 25% whose salary is less than 30000.

4. a) What do you mean by functional dependencies? Define formally. What is BCNF? [3+3]
   b) What is normalization? Explain INF, 2NF, 3NF and 4NF. [2+4]

5. Explain the basic steps in query processing. Make distinctions between cost based optimization and heuristic optimization. [4+4]

6. a) What is the use of RAID storage device? How is a record searched from a sparse sequential index? [2+3]

   b) Explain about the remote backup system with diagram. [3]

7. a) What are schedules? Describe the concept of view serializability for concurrent execution of transaction. [2+4]

   b) How deadlocks arise while processing transactions? Explain the deadlock prevention strategies. [2+4]

8. Write the different types of failures that may occurs in system. Differentiate between shadow paging and log-based recovery. [3+3]

9. Write short notes on the following: [3×2]

   i) Distributed database system
   ii) Spatial database system

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45 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2072 Ashwin

Exam.	Regular		
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

Subject: - Database Management System *(CT652)*

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt **All** questions.*
- ✓ *The figures in the margin indicate **Full Marks**.*
- ✓ *Assume suitable data if necessary.*

1. Why data independence is importance in data modeling? Differentiate between physical and logical data independence. [4]
2. Draw an ER-diagram for the following mini-case. What is the difference between strong and weak entity sets?

   Patients are treated in a single ward by the doctors assigned to them. Healthcare assistants also attend to the patients; a number of these are associated with each ward. Each patient is required to take a variety of drugs a certain number of times per day and for varying lengths of time. The system must record details concerning patient treatment and staff payment. Some staffs are paid part time and doctors and healthcare assistants work varying amounts of overtime at varying rates, the system will also need to track what treatments are required for which patients. [8+4]
3. Write relational algebra queries for (a, b, c). Write SQL queries for (i, ii, iii)
   a) Retrieve the detail of employee with eno, add, dob, phone with highest salary. [2]
      i) Create above table Emp as indicated. [2]
      ii) Find employee who earns more than 50000, works in CS department and name contains alphabet **a**. [2]
      iii) Increase salary of those employee who earns less than average by 25% [2]
   b) Find total amount spent by ECON department for its employee salary. [2]
   c) Find total number of post in CS department. [2]
4. a) What is lossless decomposition and dependency preservation? Suppose that we decompose the schema R = (A, B, C, D, E) into (A, B, C) and (C, D, E). Is it lossless decomposition? Is it dependency preserving? [3+4]
      Consider that the following set F of functional dependencies hold.
      $A \rightarrow BC$
      $CD \rightarrow E$
      $B \rightarrow D$
      $E \rightarrow A$
   b) What is the importance of normalization? Define BCNF. [2+3]
5. Explain the steps involved in query processing. What is the significance of materialized views? [6+2]
6. Write about fixed-length record and variable length record organization DBMS. Define B+ free structure used for indexing. [4+4]
7. Explain different states of a transaction along with state transition diagram. Explain conflict Serializability with example. [4+4]
8. Explain briefly two phase locking protocol for Concurrency Control. [4]
9. Explain in detail the working of log-based recovery method. [6]
10. Explain the importance of data warehouse in decision making. Write the application areas of spatial database. [3+3]

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45 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2071 Bhadra

Exam.	Regular / Back		
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

Subject: - Database Management System *(CT652)*

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt **All** questions.*
- ✓ *The figures in the margin indicate **Full Marks**.*
- ✓ *Assume suitable data if necessary.*

1. What difficulties would you face if you used file system directly to implement a database application? What is physical data independence? [3+1]

2. Draw a complete ER-diagram for the following case.

"A Bus Company owns a number of busses. Each bus is allocated to a particular route, although some routes may have several busses. Each route passes through a number of towns. One or more drivers are allocated to each stage of a route, which corresponds to a journey through some or all of the towns on a route. Some of the towns have a garage where busses are kept and each of the busses are identified by the registration number and can carry different numbers of passengers, since the vehicles vary in size and can be single or double-decked. Each route is identified by a route number and information is available on the average number of passengers carried per day for each route. Drivers have an employee number, name, address, and sometimes a telephone number."

What is the difference between the degree and cardinality of a relationship? [8 + 4]

3. Consider the following relational database model

Employee(eid, name, address, supervisor_eid)
Department(dept_id, name)
Project(pid, title, dept_id)
Works_on(eid, pid, hours)

Write relational algebra expressions for the following: [2 X 4 = 8]

a) List the name of all employees from Computer department along with the name of their supervisor.
b) Find the name of all employees who work on the "Network monitoring" project for more than 15 hours.
c) Delete all projects which belong to the "Electrical" department.
d) Find the total number of projects from each department, along with the department name.

4. Consider the relational schema given below. [2 X 4 = 8]

Product (pid, name, price, category, maker-cid)
Purchase (buyer-ssn, seller-ssn, quantity, pid)
Company (cid, name, stock price, country)
Person(ssn, name, phone number, city)

a) Write an SQL query to find the name and price of all products of "camera" category made in "Japan".

b) Write an SQL query to create a view to expose only the Buyer name, Seller name and product name from all transactions.

c) Write a query in SQL to increase the price of all products from DELL company by 5 %.

d) Write skeleton tables in QBE to find the name and phone number of all persons who purchased products of Laptop category with price greater than 80,000.

5. a) Explain what is referential integrity constraint along with an example? Briefly explain cascading actions in referential integrity constraints. [3+3]

b) Briefly explain how to normalize a database from un-normalized form to 1NF, 2NF, 3NF and 4NF? [6]

6. Explain the difference between cost-based and heuristics-based methods for query optimization. How can you optimize the following query? [3+5]

$$\Pi_{name,\ title}(\sigma_{dept\_name=\text{"Music"}}(instructor \bowtie \Pi_{course\_id,\ title}(teaches \bowtie course)))$$

7. a) What is the difference between ordered indices and hash indices in a database? What is the advantage of using a sparse index? [2+2]

b) What is a RAID? How would you choose the best RAID level for your database server? [1+3]

8. Explain Atomicity and Isolation properties of a database transaction. Describe the concept of conflict serializability for concurrent execution of transactions. [4+4]

9. Briefly explain the idea of a stable storage. Explain the architecture of a remote backup system. [3+3]

10. Write short notes on the following

a) Types of distributed databases [3]

b) Data warehousing [3]

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45 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2070 Magh

Exam.	New Back (2066 & Later Batch)		
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

Subject: - Database Management System *(CT652)*

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt **All** questions.*
- ✓ *The figures in the margin indicate **Full Marks**.*
- ✓ *Assume suitable data if necessary.*

1. Explain the difference between DDL, DML and DCL along with examples. [4]

2. Assume that at Pine Valley Furniture each product (described by Product No., Description, and Cost) is comprised of at least three components (described by Component No., Description, and Unit of Measure) and components are used to make one or many products (i.e., must be used in at least one product). In addition, assume that components are used to make other components and that raw materials are also considered to be components. In both cases of components being used to make other components, we need to keep track of how many components go into making something else.

   Draw an ER-diagram for this case. Describe what is total participation using an ER-diagram example. [8 + 4]

3. Consider the following relational database model

   Product (pid, name, price, category, maker-cid)
   Purchase (buyer-ssn, seller-ssn, quantity, pid)
   Company (cid, name, stock price, country)
   Person(ssn, name, phone number, city)

   Write relational algebra expressions for the following: [2 X 4 = 8]

   a) Find the *ssn* and *name* of all people who have purchased products of category "telephone"
   b) List the *pid* and *name* of all products which is more expensive than $500 and made in China.
   c) Increase the price of all products of "television" category by 10%.
   d) List the *ssn* and *name* of each seller along with the total quantity of products sold.

4. Consider the relational schema given below. [2 X 4 = 8]

   Hotel (Hotel_No, Name, Address)
   Room (Room_No, Hotel_No, Type, Price)
   Booking (Hotel_No, Guest_No, Date_From, Date_To, Room_No)
   Guest (Guest_No, Name, Address)

   a) Write an SQL query to list all guests who have booked rooms at the Himalayan Hotel.
   b) Write an SQL query to create a view to expose only the *Hotel_No, Guest_No, Room_No* and *Price* of the room of all booked rooms.
   c) Write a query to offer 5% discount on all rooms of type "Delux" for the Everest Hotel.
   d) Write skeleton tables in QBE to find the Check-in date and Name of all guests currently booked for the Everest Hotel.

5. a) Explain the necessary condition for decomposing a relational database table into two tables. Why is normalization needed? [4+4]

   b) Compare 3NF and BCNF normal forms? [4]

6. Explain the process how a query is evaluated in RDBMS systems. How are equivalence rules for relation algebra helpful for query optimization? Explain with example. [3+5]

7. a) Distinguish between dense index and sparse index? What is a secondary index? [3+2]

   b) Briefly explain how variable length records are stored in databases? [3]

8. What do you understand by the ACID properties of transactions? Explain with examples. [8]

9. Explain the functions of Undo and Redo operations in a log-based recovery of database. [6]

10. a) Briefly explain horizontal and vertical fragmentation in distributed databases. [3]

    b) Write a short note on Data warehouse and associated applications. [3]

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45 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2070 Bhadra

Exam.	Regular		
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

Subject: - Database Management System *(CT652)*

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt **All** questions.*
- ✓ *The figures in the margin indicate **Full Marks**.*
- ✓ *Assume suitable data if necessary.*

1. Briefly explain different levels of data abstraction in a database system. [4]
2. Draw an ER-diagram for the following mini-case. What is the difference between strong and weak entity sets? [8+4]

   Each employee in an engineering company has at most one recognized skill, but a given skill may be possessed by several employees. An employee is able to operate given machine-type (e.g., lathe, grinder) if he has one of several skills, but each skill is associated with the operation of only one machine type. Possession of a given skill (e.g., mechanic, electrician) allows an employee to maintain several machine-types, although maintenance of any given machine-type requires a specific skill (e.g., a lathe must be maintained by a mechanic).
3. Consider the following relational database model:

   employee (employee-name, street, city)
   works (employee-name, company-name, salary)
   company (company-name, city)
   manages (employee-name, manager-name)

   a) Write SQL queries for the following needs. [2×4]

      i) Modify the database so that Jones now lives in city Pokhara.
      ii) Give all employees of 'NABIL Bank' a 10 percent raise.
      iii) Give all managers of 'NABIL Bank' a 30 percent raise unless the salary becomes greater than 100,000.
      iv) Delete employee who has maximum amount of salary.

   b) The relation works has attribute company-name, company-name is primary key in relation company. How the relation between these two relations is preserved? Explain with solution with SQL query to achieve this relationship. [4]
4. a) What is a lossless-join decomposition? What is a functional dependency? Explain. [4+4]

   b) What is the advantage of 3NF over BCNF? [4]
5. What do you mean by term functional dependency? Discuss various types of functional dependencies. [6]
6. How can pipelining approach improve query-evaluation efficiency? [4]
7. a) What is the use of RAID storage device? What are the advantages and disadvantages of mirroring? [3+2]

b) What is a remote backup system? Explain. [3]

8. a) List the ACID properties. Explain the usefulness of each. [4]

b) During its execution, a transaction passes through several states, until it finally commits or aborts. List all possible sequences of states through which a transaction may pass. Explain why each state transition may occur. [4]

c) How two phase locking protocol helps in avoiding deadlock? Explain with examples. [4]

9. Suppose following contents are present in the log when a crash occurs. Explain what happens for a log-based recovery. [6]

<T_0 start>
<T_0, B, 2000, 2050>
<T_1 start>
<checkpoint {T_0, T_1}>
<T_1, C, 700, 600>
<T_1 commit>
<T_2 start>
<T_2, A, 500, 400>
<T_0, B, 2000>
<T_0 abort>

<T_2, A, 500>
<T_2 abort>

10. Briefly explain properties of distributed databases. [4]

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44 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division.
2069 Bhadra

Exam.	Regular (2066 & Later Batch)		
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

Subject: - Database Management System *(CT652)*

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt **All** questions.*
- ✓ *The figures in the margin indicate **Full Marks**.*
- ✓ *Assume suitable data if necessary.*

1. Briefly highlight your significant differences between a file-processing system and a DBMS. [4]
2. Draw an ER-diagram for the following mini-case. What is the difference between cardinality and degree of a relationship?

   A university registrar's maintains data about the following entities: (a) Courses, including number, title, credits, syllabus and prerequisites; (b) Course offerings, including course number, year, semester, section number, instructor(s), timings and classroom; (c) Students, including student-id, name, and program; and (d) instructors, including identification number, name, department, and title. Further, the enrollment of students in courses and grades awarded to students in each course they are enrolled for must be appropriately modeled. [8+4]
3. a. Mention the two conditions to be satisfied by any two sets for union, intersection and set difference operation between them. [1]
   b. employee(empname, street, city) [4×2]
   works(empname, companyname, salary)
   company(companyname, city)
   manages(empname, managername)
   For the case of above database schema:
   I. Write an expression in SQL to create the table employee.
   II. Write an expression in SQL to inset a row into the table works.
   III. Write an expression in SQL to find the name and cities of resident of all the employees who do not work for XYZ Pvt. Ltd.
   IV. Write an expression Relational Algebra to find the company name that has the highest number of employees.
   c. Suppose you are assigned as the Database Administrator of a Bank. How can you enhance the security by implementing concept of views on the database? [3]
4. What do you mean by integrity constrains? Explain any four constraints that can be enforced to database tables. [6]
5. What are the advantages of normalization of database? Explain 1NF, 2NF and 3NF. When database de-normalization is preferred? [2+3+1]
6. Explain the process of query optimization. What is cost-based optimization? [6+2]
7. What do you mean by ordered index and hash index? Explain limitation of static hashing. How extendable hashing overcome such limitation? [2+2+4]

8. a) Explain conflict serializability with example. [8]

   b) Differentiate between fine granularity and coarse granularity locking in multiple granularity locking protocol. [4]

9 Explain redo phase and undo phase of log based failure recovery mechanism. [6]

10. a) What is object-oriented databases? Explain briefly. [3]

    b) Explain the benefit of parallel database? [3]

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42 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2068 Bhadra

Exam.	Regular / Back		
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

Subject: - Database Management Systems

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt **All** questions.*
- ✓ *The figures in the margin indicate **Full Marks**.*
- ✓ *Assume suitable data if necessary.*

1. What are the drawbacks of using file systems to store data? Explain. [6]

2. Draw an ER-diagram for the following mini-case

Procurement department of the Ministry of Transportation (MOT) keeps track of all the items (furniture and equipment such as a chair or printer) in the Ministry offices. There are several MOT buildings and each one is given a different name to identify it. Each item is assigned a unique ID when it is purchased. This ID is used to keep track of the item, which is assigned to a room within a building. Each room within a building is assigned to a department, and each department has a single employee as it's manager. [8]

3. Consider the following relational database model

employee (person-name, street, city)
works (person-name, company-name, salary)
company (company-name, city)
manages (person-name, manager-name)

Write relational algebra expressions for the following: [2 X 4 = 8]

a) Find the names and street address of all employees who work for First Bank Corp. and earn more than $10,000 per annum.
b) Find the names of all employees who do not work for First Bank Corp.
c) Give all employees working at First Bank Corp. a 10 % salary raise.
d) Count the number of employees in each company.

4. Consider the following relational database. [2 X 5 = 10]

account (account-number, branch-name, balance)
branch (branch-name, branch-city, assets)
customer (customer-name, customer-street, customer-city)
loan (loan-number, branch-name, amount)
depositor (customer-name, account-number)
borrower (customer-name, loan-number)

a) Write an SQL query to list the names of all depositors along with their account number, street and city address.
b) Write a query in SQL to list the branch-cities and total assets where the total assets are more than $1,000,000 in the city.
c) Write an SQL query to find the names and loan-numbers of all customers who have a loan of over $15,000.
d) Write a query in SQL to increase all accounts with balances over $10,000 by 6%.
e) Give an expression in QBE to find the customer-name, loan-number, and amount for all customers who have a loan from the "PATAN" branch.

5. Explain the conditions of BCNF. Compare BCNF and 3NF with example. [3+5]

6. Explain the process of query optimization. What is the significance of materialized views? [6+2]

7. What is RAID? Explain the B+ tree index with an example? [3 + 8]

8. Explain the granting and revoking of privileges to database users. [5]

9. Consider the following log contents when a crash occurs. Briefly explain how a recovery would be done. [5]

<T_0 start>
<T_0, A, 1000, 950>
<T_0, B, 2000, 2050>
<T_0 commit>
<T_1 start>
<T_1, C, 700, 600>

10. What is a transaction? What is a serializable schedule? [5]

11. a) What is an ORM? [3]
    b) What is the difference between a homogeneous and a heterogeneous distributed database? [3]

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42 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2067 Mangsir

Exam.	Regular / Back		
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

Subject: - Database Management System

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt **All** questions.*
- ✓ *The figures in the margin indicate **Full Marks**.*
- ✓ *Assume suitable data if necessary.*

1. List and explain the five significant differences between a file processing and database management system. [5]

2. a) Construct an E-R diagram with proper mapping constraints for Registrar's Office that maintains data about courses, course offerings, students and instructors, enrollment of students in various courses and grades awarded to students in each course they are enrolled for must be appropriately modeled. [5]

   b) What is data definition language? Explain strong and weak entity with suitable examples. [5]

3. Consider the relational data base as follows: [3×5]

   employee (employee-name, street, city)
   works (employee-name, company-name, salary)
   company (company-name, city)
   managers (employee-name, manager-name)

   a) Write relational algebra to find the name of the manager who manages the employee "Shakti".
   b) Write a SQL statement to find the name of all employees who live in the same cities and same streets as the employee "Achyut" and the same cities as the companies for which they work.
   c) Write the QBE for: Delete all employees and who work for "XYZ" company.
   d) Write an expression in tuple relational calculus to find the name of all employees who works for "ABC" company but do not earn more than 50000.
   e) Write an expression in domain relational calculus to find the name of the employee, company name and salary for employee with earning over 50000.

4. a) What is normalization? What are their levels? State 3NF and BCNF. [2+1+4]

   b) What do you mean by trival and non-trival functional dependencies? [3]

5. a) What do you mean by file organization? Why dynamic hashing is needed? [5]

   b) Let R = (A, B, C, D, E, F) and F = {A→BC, E→AF}. Decompose R to get all smaller relations in BCNF. [5]

6. a) What are the properties that must be hold by transaction? Explain the usefulness of each. [5]

   b) Differentiate between primary index and secondary index. [5]

7. a) Explain deffered database modification technique of log based recovery with examples. [8]

   b) How do you estimate query cost? [2]

8. Write short notes on: (any two) [2×5]

   a) Object containment
   b) Multiple granularity locking
   c) Query optimization

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42 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2065 Kartik

Exam.	Back		
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

Subject: - Database Management System

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt **All** questions.*
- ✓ *The figures in the margin indicate **Full Marks**.*
- ✓ *Assume suitable data if necessary.*

1. List and explain all the aspects of database system that might be subjects to change in physical storage. [6]
2. How do you represent composite and multivalued attributes of E-R diagram in tables? Explain with example. [4]
3. Construct an E-R diagram with proper mapping constraints, attributes and relationship sets for book shopping center that has entity sets book, author, publisher, customer, shopping-basket and warehouse. [4]
4. Consider the relational database as follow [2×7]

   account (account-number, branch-name, balance)
   branch (branch-name, branch-city, assets)
   customer (customer-name, customer-street, customer-city)
   loan (loan-number, branch-name, amount)
   depositor (customer-name, account-number)
   borrower (customer-name, loan-number)

   a) Give an expression in the relational algebra to find the name of all customers who have a loan at KANTIPATH branch but do not have an account at any branch of the bank.
   b) Give an expression in the relational algebra to find the name of all customers who live in the same street as BINOD.
   c) Give an expression in tuple relational calculus to find the name of all customers who have a loan and an account at the bank.
   d) Give an expression in domain relational calculus to find the name of all customers who have a loan of over $12000.
   e) Give an expression in SQL to delete all loans with loan amount between $1400 and $1700.
   f) Give an expression in SQL to find the name of all customers who have a loan at the bank but do not have an account at the bank.
   g) Give an expression in QBE to provide as a gift for all loan customers of the PATAN branch, a new $200 savings account for every loan account they have, with the loan number serving as the account number for the new savings account.

5. a) Suppose that we decompose the schema R = (A, B, C) into R_1 = (A, B), R_2 = (A, C). Show that this decomposition is a lossless-join decomposition and not dependency preserving if the F = {A → B, B → C}. [6]

b) What are the minimal conditions that must be hold by a relation schema R to be in third normal form (3NF)? [2]

6. What are the major disadvantages of using materialization approach for evaluation of expression? And how does pipelining approach overcome those disadvantages? [6]
7. Discuss the pointer method to represents the variable records by fixed-length representation. How does anchor and overflow block improve the pointer method? [6]
8. What are the different roles are created and granted to users in database? Discuss the authorization grant graph and attempt to defeat authorization revocation. [2+2]
9. How checkpoint mechanism improves the performance of log based crash recovery techniques? Explain. [8]
10. What do you mean by cascading rollback and why this must be removed? How strict two phase locking protocol improves the two phase locking protocol? [3+3]
11. How and why data replication and fragmentation techniques are used in distributed data storage? [6]
12. Write short notes on: [2×4]

a) Recursive Relationship
b) Compensating Transaction

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